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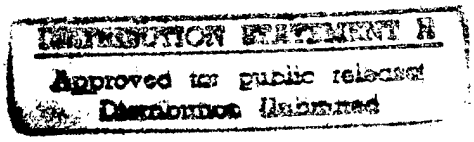

International Cooperation in Test & Evaluation- A Critical Dimension

Richard R. Ledesma and Frederick D. Mabanta

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International cooperation in test and evaluation (T&E) has been taking place for the past 20 years under the leadership of the Office of the Under Secretary of Defense (Acquisition and Technology) with each of the military services pursuing aspects of the program. Current downsizing trends and advances in weapons technologies present the T&E community with challenges that can best be met as a world community with programs that permit the sharing of assets—skills, capabilities, technologies, and ideas.

T&E has demonstrated its value over the years as an area for international cooperation. The downsizing taking place throughout the world's military establishments has intensified the focus in this area. T&E, with its large industrial structure of ranges and facilities and high-technology test capabilities, provides great potential for achieving economies through cooperation. Indeed, several countries are considering the closure of test facilities on the basis of capabilities available in other countries. The United States is also exploiting the availability of allied capabilities to preclude costly investments in new facilities. The concept of an international "reliance" on T&E appears to be emerging. It is prudent to seize on this trend and promote its implementation.

Several instruments are already in place that provide a basis for pursuing cooperative efforts in T&E. A Memorandum of Understanding (MOU) on Mutual Acceptance of Test and Evaluation among the four powers of France, Germany, the United Kingdom, and the United States, has been in place since 1983 and has been used extensively for development of mutual test procedures. Similar bilateral MOU's are also in place with Spain and Israel. Additionally, there are several Data Exchange Agreements (DEA's) on proving ground techniques with the countries of France, Germany, Sweden, The Netherlands, Israel, South Korea, and Australia. Several additional MOU's and DEA's with other countries are currently being prepared to further expand the base of cooperative test and evaluation efforts.

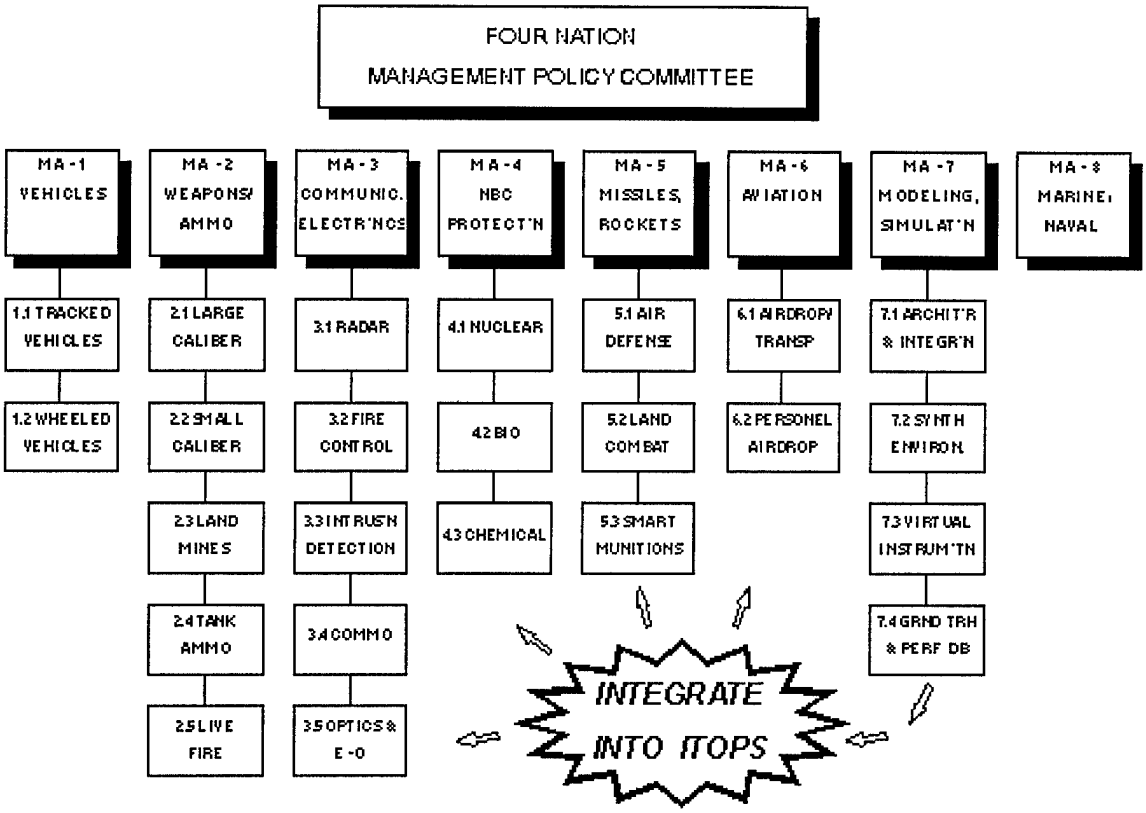

Figure 1. International Test Operations Procedures Management Structure

There are many opportunities for international cooperation in T&E. The following provide the greatest potential for economic and technical benefit to the international T&E community.

Test Procedure Standardization

Test procedure standardization is a proven "enabler." The concept has been in existence for more than 10 years under the International Test Operations Procedures (ITOP's) program managed by the countries of France, Germany, the United Kingdom, and the United States. This program has produced 78 ratified procedures, with an estimated additional 50 in various stages of preparation. Cooperatively developed by world subject matter experts, ITOP's are international agreements that document state-of-the-art T&E procedures for testing military materiel. The use of ITOP's provides confidence that tests are conducted with quality procedures and produce test data that are acceptable by another country for evaluation, thus avoiding the need for retesting and resulting in cost and time savings.

Modeling and Simulation

As the world moves increasingly toward the cooperative acquisition of military and commercial off-the-shelf equipment, technology sharing, and coalition operations, standardized test procedures become more relevant and beneficial. Rapid advances in weapons and testing technology make them even more crucial. For example, modeling

and simulation (M&S) is being used increasingly in both materiel development and testing with new applications being explored at a phenomenal pace.

Test procedures used in connection with testing simulated systems and subsystems with equally advanced simulation testing tools provide a great degree of complexity that the tester must master. The expanding use of modeling and simulation in the development and testing of complex weapon systems allows the developer to explore a wide variety of alternative designs in the early trade-off of key technical and operational features at the component and subsystem level and at the system level. This provides the developer the means of quantifying the technological risk associated with a particular design, and through the application of a family of M&S tools, demonstrates the effectiveness of the particular design well in advance of actual field testing.

Of course, the M&S tools used for this purpose must undergo a rigorous certification process better known as verification and validation (V&V). The V&V process demands the M&S results be corroborated either by real field test results or by combat itself. These certified M&S tools must be able to predict field test results and be confirmed by those results. Test methods and procedures play a crucial role in this traceability. The international implications of these V&V methods and procedures will be particularly important as more countries apply M&S increasingly to shorten their development and testing efforts. Consider for example, a system developed by one country that is to be purchased by another country. If the evaluation of that system was based on data obtained predominantly from simulation trials, a costly full-scale retesting program may be required unless the purchasing country has confidence in the simulation results.

Technology Management Areas

The ITOP program encompasses eight technology management areas:

(1) Vehicles
(2) Weapons/Ammunition
(3) Communications/Electronics
(4) Nuclear/Biological/Chemical Protection
(5) Missiles/Rockets
(6) Aviation
(7) Modeling/Simulation
(8) Marine/Naval

Each area is managed by one or more working groups depending on the number of subareas it includes (as shown in figure 1). Management areas 7 & 8 were added last year. The M&S management area will be unique since it will not directly produce M&S-based ITOP's. Instead it will focus on M&S fundamentals such as the architecture and standards necessary for integration into the other series of ITOP's.

Program Expansion

The success of the ITOP program and its potential for expansion is being exploited to include other military Services, other countries, and new technology areas.

- Other Services.

Initiated predominantly for land systems, each of the Four Power countries has expanded its focus to include air and sea systems ITOP development.

- Other countries.

Several additional countries have expressed interest in participating in the development of ITOP's. Initially, these activities will be pursued as bilateral efforts with the United States.

- New technology areas.

M&S and Marine/Naval were added last year as a new technology management areas. Other technology areas will be added as needed.

Country interactions stemming from the ITOP program have spun off other cooperative efforts and benefits. For example, reciprocal visits between countries to observe testing and assess test capabilities firsthand and the dialogue with international colleagues are important aspects of international T&E since they instill confidence in ITOP results. As testers become aware of test and simulation capabilities in other countries and the testing challenges facing other countries, there naturally emerges the area of accessing those capabilities instead of investing limited resources on acquiring duplicative capabilities at home. There have also been a number of occasions when one country has become aware of a new test technology in another country and applied that technology at home to great benefit. Not only has this saved the cost of development, but the new technology may not have even been considered had it not become known through ITOP interaction. Thus ITOP's, while focused on the development of standard test procedures, also provide a basis for other international cooperative endeavors.

Cooperative Use of Test and Simulation (T&S) Facilities

The cooperative use of T&S facilities provides an opportunity-rich environment for achieving economies and efficiencies through the use of allied facilities in lieu of investing in costly new facilities. There are many T&S facilities throughout the world that are one-of-a-kind to fit a particular need and have not been duplicated because of the high cost involved in their development and construction. In this era of declining defense budgets, there is neither investment capital nor perhaps the volume of work to justify each nation possessing all of the capabilities it needs. A wiser course suggests one capitalize on those capabilities already in existence through shared use.

While this idea may be obvious and attractive, putting it into practice will require some effort. First, international agreements will have to be reached in such matters as pricing policy, priority of use, third-party liability, protection of intellectual and proprietary rights, etc. Second, appropriate information on test capabilities will have to be made available. And third, a process will have to be put in place to implement the concept.

Reciprocal Agreements

The idea of using another country's test facilities is not new. Many foreign governments have tested their systems in the United States, and the United States has tested many of its systems in other countries. However, these instances have been handled on a case-by-case basis, usually under "Foreign Military Sales" arrangements. Formal reciprocal-use agreements that provide equitable price structures and address the issues of testing priority, logistics, intellectual property rights, and other legal matters need to be developed to facilitate the process. Many countries are expressing this line of thought. Such an agreement already exists under a Diplomatic Exchange of Notes with Canada called the Canadian-United States Test and Evaluation Program. It has been highly successful for more than 10 years!

Directories of Test Capabilities

Recognizing that testers must be familiar with test capabilities in other countries before those capabilities can be sought and used, the U.S. Army Test and Evaluation Command (TECOM) in 1990, produced an International Test Facilities and Ranges Summary of Capabilities catalog. Originally covering test capabilities of five countries, a recently completed revision now under a U.S. Department of Defense logo, expands coverage to eight countries: Canada, France, Germany, the United Kingdom, United States, Israel, Australia, and Sweden.

The European test community is also moving in the direction of shared test facilities. The Western European Armaments Group (WEAG) has just published a "Directory of Test Centres." The group is composed of thirteen countries: Belgium, Denmark, France, Germany, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Turkey, and the United Kingdom. Collectively, these documents describe test capabilities at over 200 test facilities and centers in thirteen countries. The catalogs and directories will undoubtedly foster and facilitate reciprocal use of test facilities. Ultimately, these documents will be made available via the World Wide Web, which will make them even more accessible.

While there has been considerable discussion between countries on the subject of cooperative use of test facilities, efforts to date have been ad hoc since there is no formal organized group in many of the countries to promote and oversee such a process. This may ultimately be required.

Test Technology (TT) Transfer

TT transfer is a unique area that has been little exploited. The development and acquisition of test technologies (i.e., instrumentation and/or procedures) are complex, costly, and time consuming. Each country has many unique and specialized test technologies under development. If already developed technologies are shared, they can greatly reduce future cost by eliminating redundant development. There are many examples which clearly illustrate these benefits and potentials, but most of these technology transfers occurred by happenstance - the result of one country's accidentally becoming aware of a new test technology in another country and adapting or purchasing it. Technology transfers can be accomplished with varied approaches. A few examples are described below.

Direct Technology Exchange

The United States, France, and Sweden are exchanging information on range technologies. The United States is evaluating French and Swedish projectile catch box designs for application to depleted uranium test firings in the United States. These designs, which use self-cleaning technology, have the potential of saving millions of dollars annually in clean up of depleted uranium residuals. Reciprocally, France and Sweden are interested in U.S. developments in acoustic scoring technology and the Hardened Subminiature Telemetry and Sensor System.

Collaborative Technology Effort

The United States and Germany collaborated on the development of new ballistic shock protection specification requirements for armored vehicles. These specifications,

developed through test technology research and development, provide new insights into shock phenomena which negate previous, erroneous specifications. This collaborative effort saved the United States an estimated $1 million. Significant savings have also been realized in development of the Abrams Tank and the Crusader advanced field artillery system through more accurate design by using the new specifications.

Reiterative Technology Sharing

The Projectile Follower instrument which is capable of providing visual in-flight performance data of high-speed, low-trajectory projectiles, is another example of shared test technology. Originally designed in the United Kingdom, the Projectile Follower provided the genesis for a modified U.S. design. The U.S. design in turn provided the springboard for a further design improvement in the United Kingdom system. This "rotating" of technology between the two countries resulted in continuing technology maturation benefiting both countries.

There has been no formal effort directed at exploiting the potential of international test technology sharing. This is clearly a promising area that should be pursued.

The Future

International cooperation is crucial as governments downsize. We have seen the necessity and value of this as we have brought our testers and developers together to work more closely with each other, as we are now bringing the Services together to intensify interservice cooperation, and as we strive to form partnerships with our industry.

We must also apply this philosophy internationally. Yes, it may be a little more complex to accomplish - agreements are needed to address legalities, logistics, and security _ and there are considerable distances over which to travel and communicate. But the benefits make the effort worthwhile.

RICHARD R. LEDESMA oversees all international T&E activities as Deputy Director for Test, Systems Engineering, and Evaluation in the Office of the Under Secretary of Defense (Acquisition and Technology). He is also responsible for oversight of the Joint Technical Coordinating Groups for Aircraft Survivability and Munitions Effectiveness, the Precision Guided Weapons Countermeasures T&E Directorate, and the Joint T&E Program.

FREDERICK D. MABANTA is a senior engineer/analyst with Science Applications International Corporation. Before joining SAIC in January 1996, he was the chief contact for international test and evaluation issues at the U.S. Army Test and Evaluation Command. He served as the U.S. representative to the Four Power Management Policy Committee for ITOP's, the U.S. Army representative to the U.S./U.K. Group on Explosive Safety, and as technical project officer for several international data exchange agreements.

For more information contact
Frederick D. Mabanta
Commercial (410) 538-5322